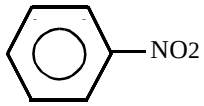
NITROBENZENE

Nitrobenzene is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 98-95-3

Molecular Formula: $C_6H_5NO_2$



Nitrobenzene is a greenish-yellow crystalline solid or colorless to pale yellow, oily liquid with an almond oil odor. Nitrobenzene is soluble in about 500 parts water and freely soluble in alcohol, benzene, ether, acetone, and oils. It is also combustible with steam (Merck, 1989).

Physical Properties of Nitrobenzene

Synonyms: nitrobenzol; essence of mirbane; oil of mirbane

Molecular Weight:	123.11
Boiling Point:	210 - 211 °C
Melting Point:	6 °C
Flash Point:	88 °C (closed cup)
Vapor Density:	4.3 (air = 1)
Vapor Pressure:	1 mm Hg at 44.4 °C
Density/Specific Gravity:	1.205 at 15/4 °C (water = 1)
Log Octanol/Water Partition Coefficient:	1.85
Henry's Law Constant:	2.44 x 10^5 atm-m^3/mole
Conversion Factor:	1 ppm = 5.04 mg/m^3

(Howard, 1990; HSDB, 1991; Merck, 1989; U.S. EPA, 1994a)

SOURCES AND EMISSIONS

A. Sources

Nitrobenzene is primarily used for the production of aniline. It is also used in soaps, in shoe polishes, for refining lubricating oils, in the manufacture of pyroxylin compounds, and as a solvent. Nitrobenzene is also a product of the photochemical reaction of benzene with oxides of nitrogen (HSDB, 1991). Nitrobenzene has been detected but not quantified in motor vehicle exhaust (ARB, 1990b).

The primary stationary sources that have reported emissions of nitrobenzene in California are colleges and universities, manufacturers of electronic components and accessories, and research and testing services (ARB, 1997b).

B. Emissions

The total emissions of nitrobenzene from stationary sources in California are estimated to be at least 380 pounds per year, based on data reported under the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

No information about the natural occurrence of nitrobenzene was found in the readily-available literature.

AMBIENT CONCENTRATIONS

No Air Resources Board data exist for ambient measurements of nitrobenzene. However, the United States Environmental Protection Agency (U.S. EPA) has compiled ambient air data from several urban and suburban locations throughout the United States from 1976-82. The overall mean concentration was 0.61 micrograms per cubic meter ($\mu g/m^3$) or 0.12 parts per billion (U.S. EPA, 1993a).

INDOOR SOURCES AND CONCENTRATIONS

In June, 1990, 88 households in Woodland, CA were monitored for nitrobenzene. Only 15 percent of the samples were above the quantifiable limit of 0.32 nanograms per cubic meter (ng/m^3). All measurable samples contained less than 5 ng/m^3. Outdoor air concentrations from this study were comparable to indoor concentrations (Sheldon et al, 1992).

ATMOSPHERIC PERSISTENCE

Nitrobenzene exists in the atmosphere in the gas phase. The dominant chemical loss process for nitrobenzene in the troposphere is expected to be by reaction with the hydroxyl (OH) radical, although photolysis may be important. The calculated half-life and lifetime of nitrobenzene due to reaction with the OH radical are 2 months and 3 months, respectively (Atkinson, 1989). No experimental product studies have been carried out to date.

AB 2588 RISK ASSESSMENT INFORMATION

The Office of Environmental Health Hazard Assessment reviews risk assessments submitted under the Air Toxics "Hot Spots" Program (AB 2588). Of the risk assessments reviewed as of December 1996, for non-cancer effects, nitrobenzene did not contribute to a total chronic or acute hazard index greater than 1 in any of the risk assessments (OEHHA, 1996b).

HEALTH EFFECTS

Probable routes of human exposure to nitrobenzene are inhalation, ingestion, and dermal contact (Sittig, 1991).

Non-Cancer: Nitrobenzene causes methemoglobinemia, headache, cyanosis, weakness, and gastrointestinal upset (U.S. EPA, 1994a). It may cause skin sensitization (Sittig, 1991). Individuals with glucose-6-phosphate dehydrogenase deficiency are at increased risk of methemoglobinemia. Persons with a history of blood dyscrasia, reactions to medications, or those with eye, skin, and cardiovascular disease may also be at increased risk (HSDB, 1991).

A chronic non-cancer Reference Exposure Level (REL) of 1.7 $\mu g/m^3$ is listed for nitrobenzene in the California Air Pollution Control Officers Association Air Toxics "Hot Spots" Program, Revised 1992 Risk Assessment Guidelines. The toxicological endpoints considered for chronic toxicity are the gastrointestinal system, liver, and kidney (CAPCOA, 1993).

The U.S. EPA is currently reviewing the Reference Concentration (RfC) for nitrobenzene. However, they have calculated a provisional RfC of 2.0 micrograms per cubic meter. The U.S. EPA estimates that inhalation of this concentration, over a lifetime, would not likely result in the occurrence of chronic non-cancer effects. The U.S. EPA has established an oral Reference Dose (RfD) of 5×10^{-4} milligrams per kilogram per day for nitrobenzene based on hematologic, adrenal, renal, and hepatic lesions in rats and mice. The U.S. EPA estimates that consumption of this dose or less, over a lifetime, would not result in the occurrence of chronic, non-cancer effects (U.S. EPA, 1994a).

No information is available regarding adverse reproductive or developmental effects in humans. Adverse reproductive effects seen in animal studies include a decrease in fertility, reduced testicular weights, and decreased sperm production (U.S. EPA, 1994a).

Cancer: The State of California has determined under Proposition 65 that nitrobenzene is a carcinogen (CCR, 1997). The U.S. EPA has classified nitrobenzene as Group D: Not classifiable as to human carcinogenicity (U.S. EPA, 1994a). The International Agency for Research on Cancer has classified nitrobenzene as Group 2B: Possible human carcinogen based on sufficient evidence in experimental animals (IARC, 1996b).